



The EXPLORATION Initiative

Information Systems Division

All-hands meeting

May 24, 2004

From the Earth to the Moon, and then on to Mars.

And maybe, just maybe, someday – the stars!

HVF NASA/GSFC

Outline



- Background on Exploration Initiative
- Goddard Core Competencies
- Potential Goddard Contributions
- Current activities
- Next steps

A New Future for U.S. Civil Space Programs



"This cause of exploration and discovery is not an option we choose; it is a desire written in the human heart."

President George W. Bush
February 4, 2003

"We leave as we came, and God willing as we shall return, with peace and hope for all mankind."

Eugene Cernan (Commander of last Apollo mission)
December 17, 1972

"... America will make those words come true."

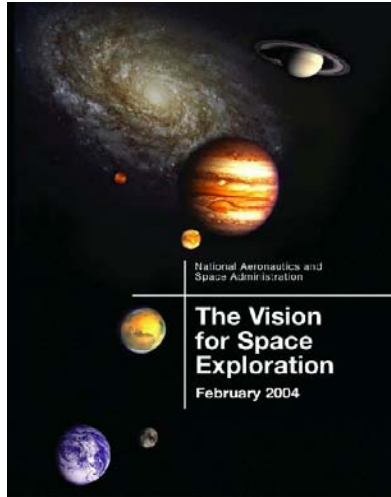
President George W. Bush
January 14, 2004



- On January 14, 2004, President Bush articulated a new Vision for Space Exploration in the 21st Century
- This Vision encompasses a broad range of human and robotic missions, including the Moon, Mars and destinations beyond
- It establishes clear goals and objectives, but sets equally clear budgetary 'boundaries' by stating firm priorities and tough choices
- It also establishes as policy the goals of pursuing commercial and international collaboration in realizing the new vision

The Vision for Space Exploration - National Benefits

Key Role of Innovation and Technology...



- **Background**

- “...U.S. achievements in space...have led to the development of technologies that have widespread applications to address problems on Earth...

- **Policy Objective (Technology)**

- “Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration...

- **National Benefits (Technology)**

- “The space missions in this plan require advanced systems and capabilities that will accelerate the development of many critical technologies, including power, computing, nanotechnology, biotechnology, communications, networking, robotics, and materials”.
- “These technologies underpin and advance the U.S. economy and help ensure national security.”



Key Elements of the Nation's Vision

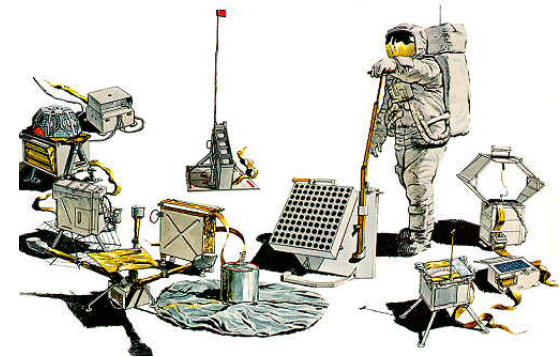


- **Objectives**

- Implement a sustained and affordable human and robotic program
- Extend human presence across the solar system and beyond
- Develop supporting innovative technologies, knowledge, and infrastructures
- Promote international and commercial participation in exploration

- **Major Milestones**

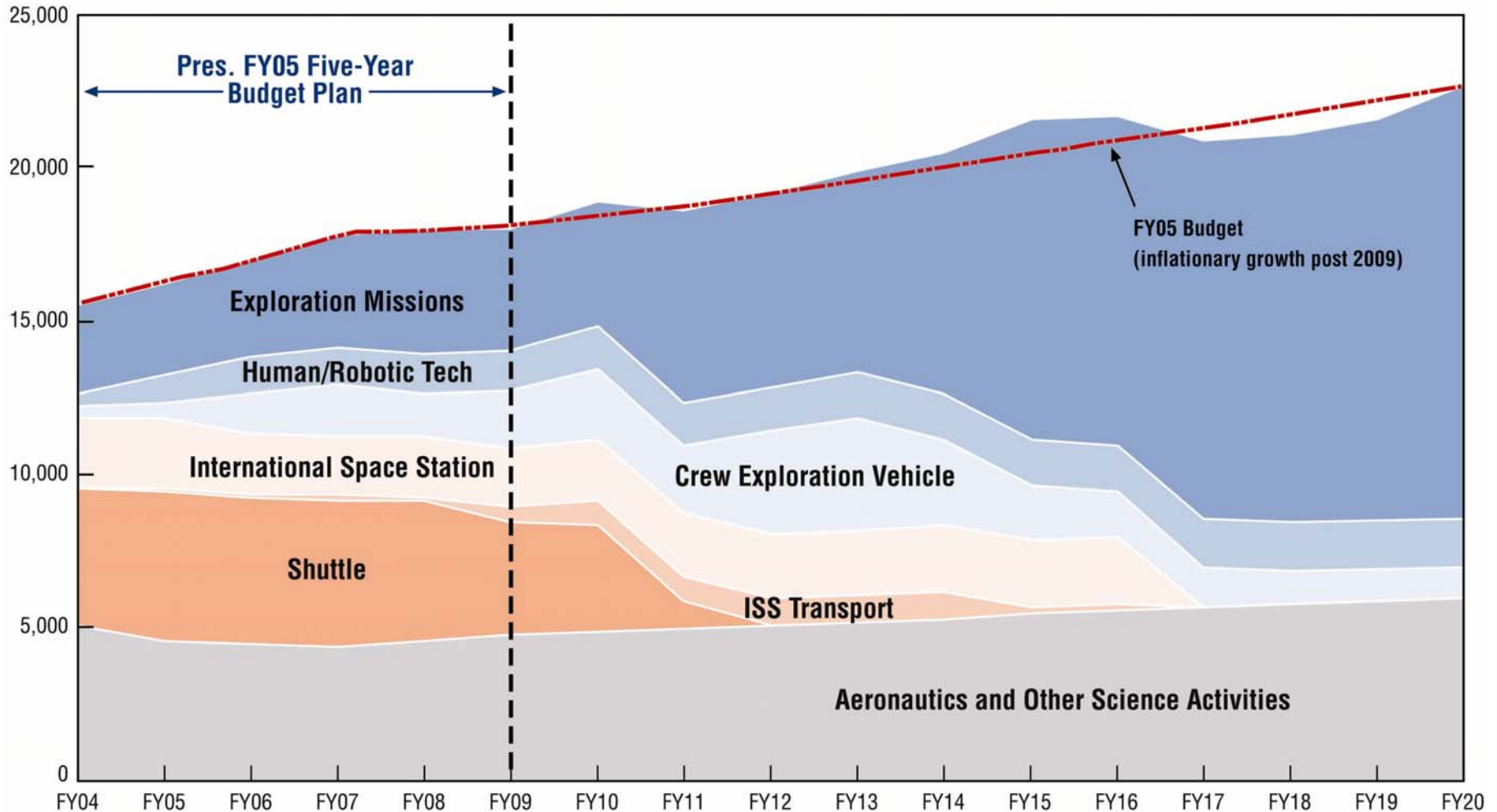
- 2008: Initial flight test of CEV
- 2008: Launch first lunar robotic orbiter
- 2009-2010: Robotic mission to lunar surface
- 2011 First Unmanned CEV flight
- 2014: First crewed CEV flight
- 2012-2015: Jupiter Icy Moon Orbiter (JIMO)/Prometheus
- 2015-2020: First human mission to the Moon



Strategy Based on Long-Term Affordability



\$ in millions



NOTE: Exploration missions – Robotic and eventual human missions to Moon, Mars, and beyond, includes Origins
 Human/Robotic Technology – Technologies to enable development of exploration space systems
 Crew Exploration Vehicle – Transportation vehicle for human explorers
 ISS Transport – US and foreign launch systems to support Space Station needs especially after Shuttle retirement

Preparing for Mars Exploration



- **Moon as a test bed to reduce risk for future human Mars missions**
 - **Technology advancement** reduces mission costs and supports expanded human exploration
 - **Systems testing** and technology test beds to develop reliability in harsh environments.
 - **Expand mission and science surface operations** experience and techniques
 - **Human and machine collaboration:** Machines serve as an extension of human explorers, together achieving more than either can do alone
 - **Breaking the bonds of dependence on Earth:** (e.g./Life Science/Closed loop life support tests)
 - **Power generation and propulsion** development and testing
 - **Common investments** in hardware systems for Moon, Mars and other space objectives





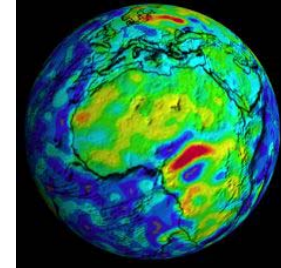
Goddard Core Competencies

GSFC Core Competencies



- **Experimental & Theoretical Science**

- *Our scientists conduct research and development of theories and concepts unifying existing knowledge and laying the foundation for experimental science, to lead the definition of requirements for sensors, instruments, spacecraft, and data systems.*



- **Sensors, Instruments, & Associated Technology**

- *Our engineers and technicians develop new technologies in such areas as optics, electro-optics such as lasers, mechanisms, and cryogenics that are used to develop sensors and instruments. We nominally have 40-50 instruments in development.*



- **End-to-End Mission Systems Engineering**

- *Our engineering organization possesses the full suite of engineering skills that provide the capability to perform or lead implementation of all mission systems required to design, develop, test, and evaluate, as well as operate scientific spacecraft.*



GSFC Core Competencies



- **Advanced Flight & Ground Systems Development**

- *We develop spaceflight systems and ground systems for spacecraft communications, operations, and data processing. These systems control the spacecraft, instruments, and data transfer.*



- **Large Scale Scientific Information Systems**

- *We develop and manage large scale scientific information systems that provide the capability to archive data from multiple spacecraft and multiple instruments, to distribute information to users across the world, and to provide the massive computational capability to use extremely large and complex data sets.*



- **Program & Project Management**

- *Our people possess experience in the full suite of management, technical, and administrative skills required to successfully manage multiple, discrete projects simultaneously. In FY04, we have 17 projects in implementation and 22 in formulation.*



Exploration Systems Enterprise Organizational Elements

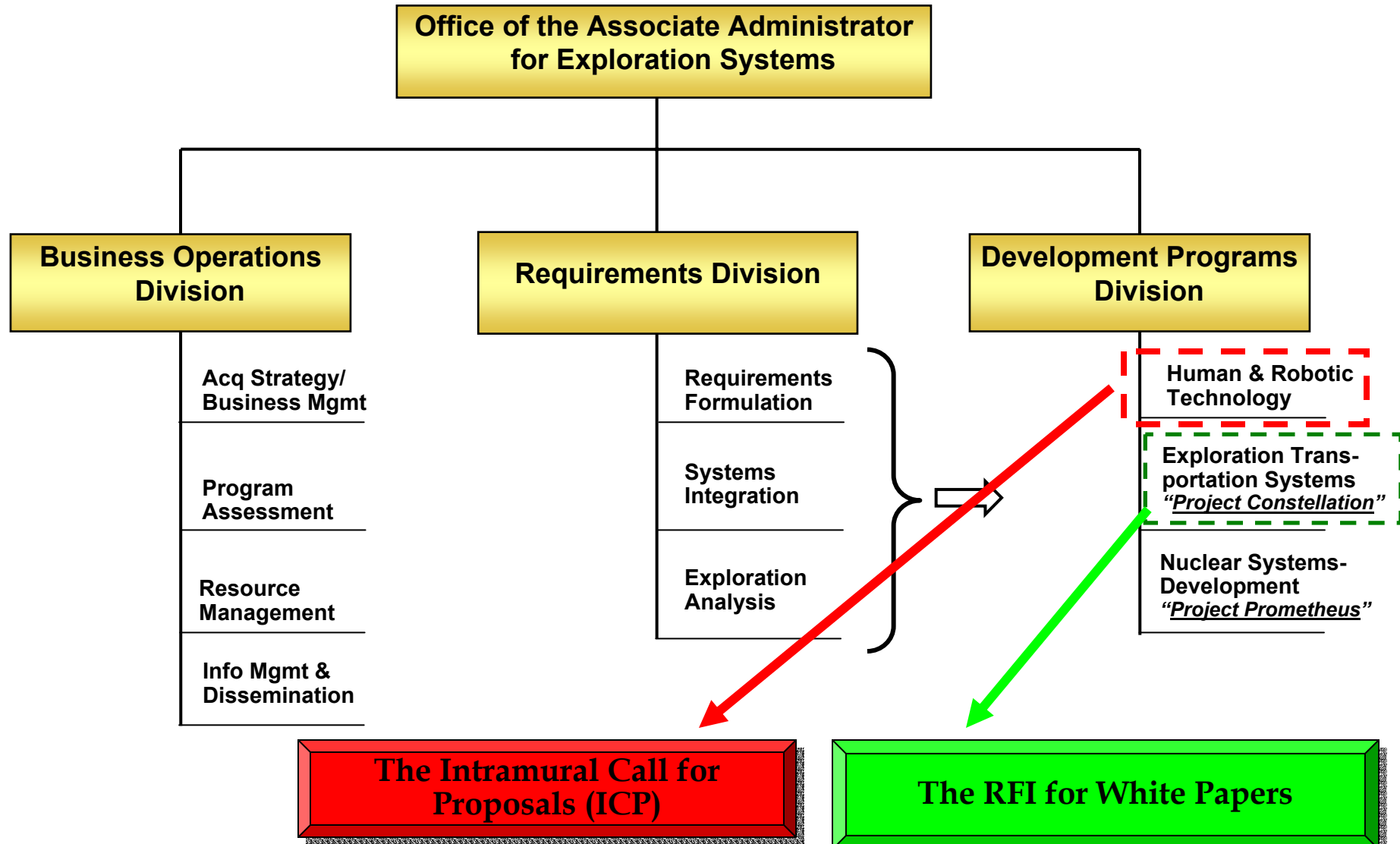


- Robotic Lunar Orbiters/Landers
- Launch Vehicles
- Crew Exploration Vehicle
- Space Transportation Systems
- Supporting In-Space Systems
- Supporting Surface Systems

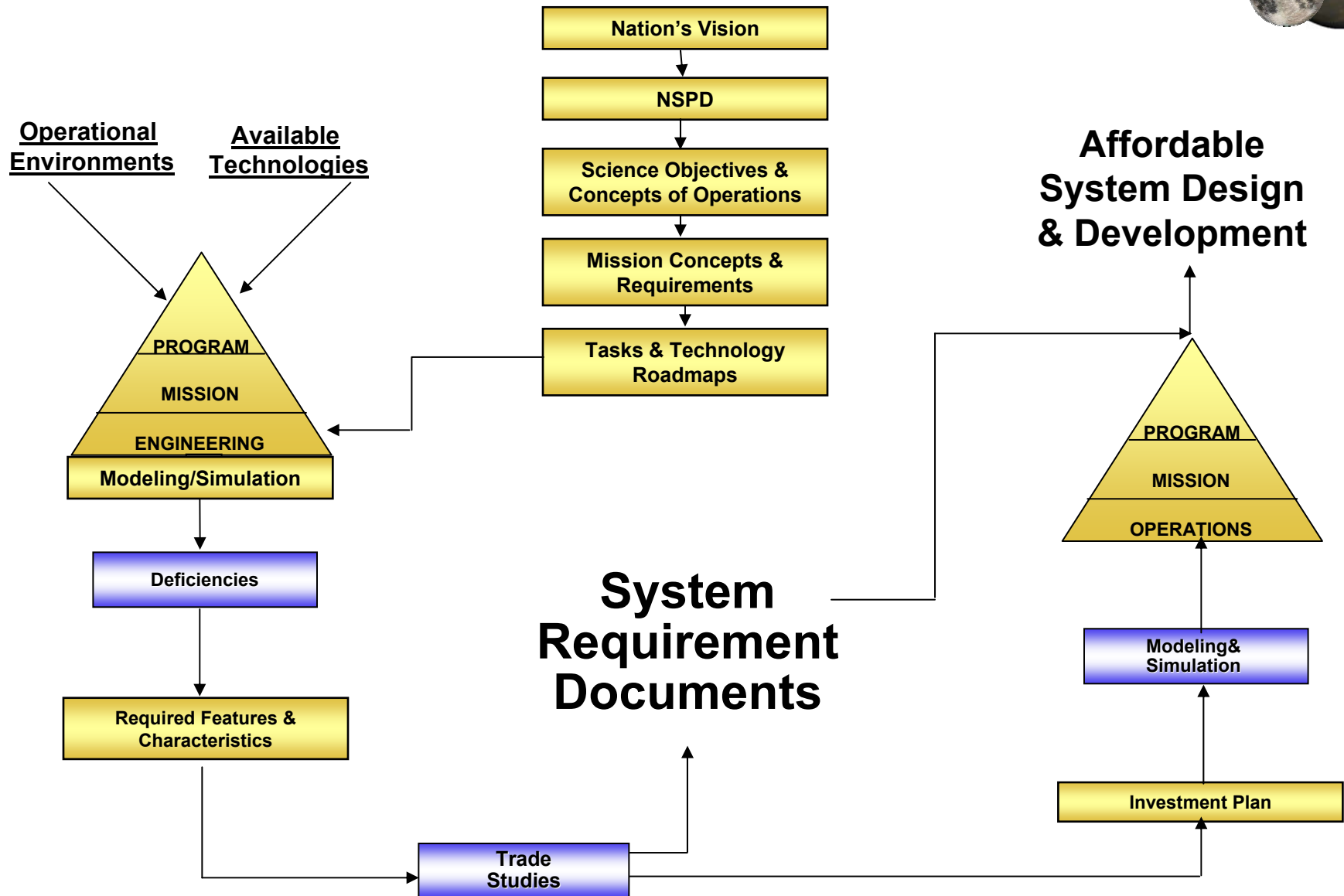


Current Activities

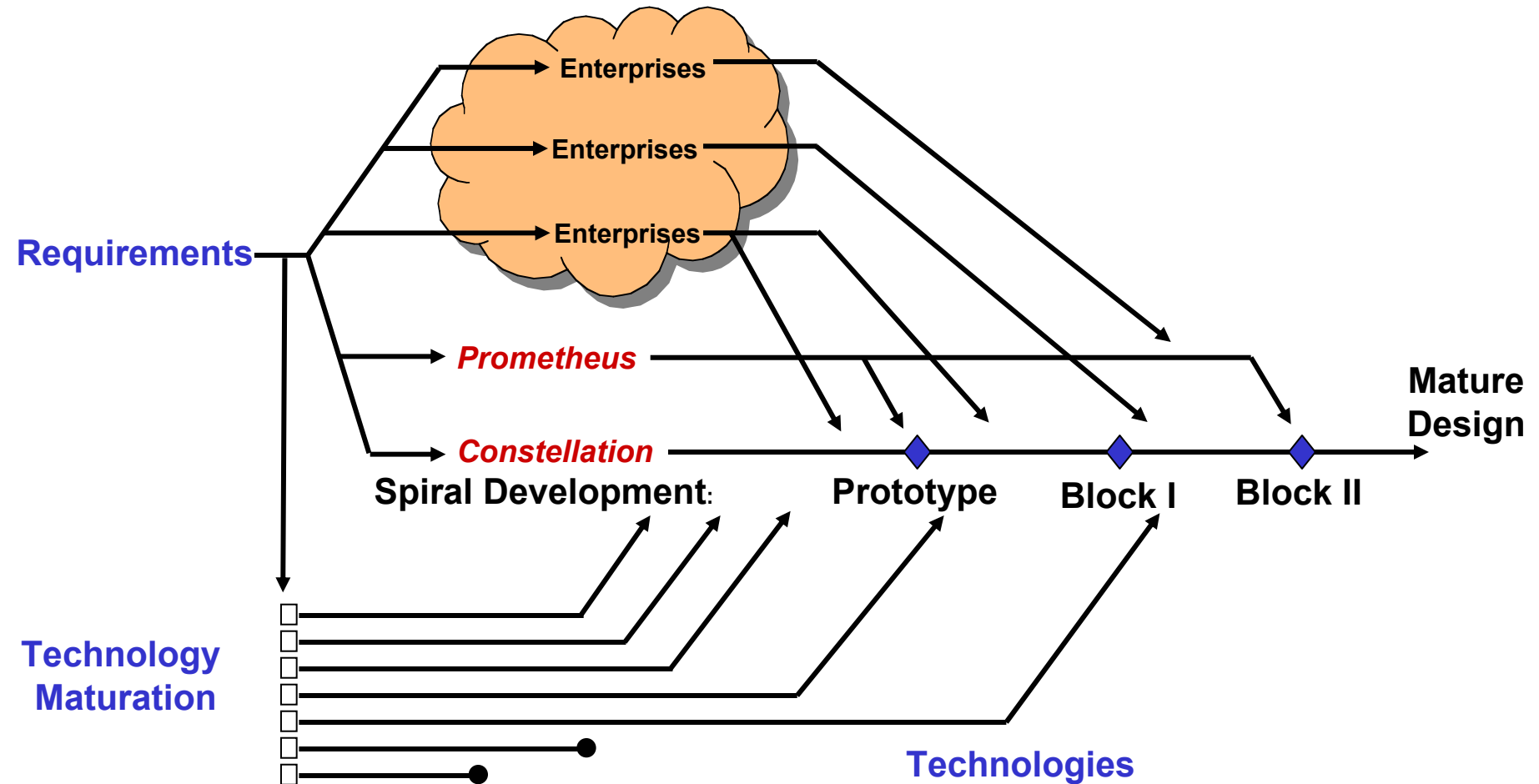
Office of Exploration Systems (OExS) Organization



Strategy-to-Task-to-Technology Process



Requirements and Technology Investment Flow





Development

Major Elements

Project Constellation

- Development of a Crew Exploration Vehicle

- **Project Prometheus**

- The Nuclear Systems Program...

- **Advanced Space Technology**

- Advance and mature a range of novel concepts and high-leverage technologies and transition them to application in the Exploration Systems Enterprise and other NASA Enterprises...

- **Technology Maturation**

- Develop and validate novel concepts and high-leverage technologies to enable safe, affordable, effective and sustainable human and robotic exploration...

- **Innovative Technology Transfer Partnerships**

- Enable the creative use of intellectual assets both inside and outside NASA to meet Agency needs and to benefit the Nation...

Office of Explorations System's FY04 Products



Requirements Division

- Crew Exploration Vehicle (CEV) Level 1 requirements and concepts of operations
- Lunar Orbiter and Lunar Lander Mission Level 1 requirements with supporting documentation
 - Technology guidelines, initial concepts, and use of existing hardware
- Prometheus Level 1 capability development requirements

Development Division

- Work Breakdown Structure (WBS) based on requirements for Exploration Systems
- Re-aligned Advanced Space Technology, Technology Maturation, and NGLT demonstration technology projects plus OSP and NGLT lessons-learned
- Investment Plan based on WBS gap analysis
- Single Acquisition Management Plan Framework to include:
 - Key Performance Parameters (KPPs), and Operational Thresholds and Objectives
 - Spiral Development Objectives and Milestones
 - Acquisition Strategy/Acquisition Program Baseline (APB)
 - Performance-Based measures for cost, schedule & performance
 - Integrated Baseline Reviews, EVMS tracking, Risk Analysis and Mitigation, Entrance/Exit Criteria...
- Industry concept studies
- Award Prometheus JIMO follow-on award

Office of Explorations System's FY04 Products (continued)



Business Operations Division

- Acquisition strategy & business formulation
 - Enterprise system single acquisition and management plan (SAMP)
- Resource management
 - Establish disciplined funds obligation & cost execution process
 - Match workforce competencies with mission needs
- Program assessment
 - Create integrated program & financial management module (EVMS)
- Information management & dissemination
 - Develop automated presentation archive & retrieval system, education plan, web site...
- Conduct several NASA / Industry Days
- Complete charter and first draft of Exploration Systems Master Plan
- Formulate / Implement / Enforce Broad Agency Announcement (BAA) Strategy

Since 14 January 2004



- Office of Exploration Systems established and populated
- NASA Day / Industry Day
- Baseline reviews of 140 Technology Programs
- Reformulation of Prometheus Program
- Initiation of Broad Agency Announcement Strategy / Plan
- Requirements Division training in Strategy-to-Task-to-Technology
- Lessons Learned assessment
 - OSP, NGLT, Space Shuttle, International Space Station...
- FY 2006 Program Operating Plan drafted
- Level Zero Requirements released 1st week April, 2004
- Creation of Human & Robotics Technology Formulation Team (across NASA) - Kickoff meetings 4/28 & 29
- Project Constellation RFI released 4/21, white papers due 5/20
- H&RT RFP released 5/14, proposals due 6/14 (NOIs due 5/21)
- Tasks being defined and send to the Centers (launch vehicle infrastructure, mission operations infrastructure, etc)

Recent Activities at Goddard



- Weekly science “Moon Meetings”
- Weekly Exploration Task Group meetings
- Weekly Code T Point of Contact telecons
- Visited JSC to explore potential partnerships
- Identified several Subject Matter Experts for 8 different Human & Robotic Technology (H&RT) Programs – coordinating H&RT technology RFP responses
- Coordinated the Presidential Commission visit.
- Coordinating Code T POP preparation
- Preparations underway to visit Langley for potential partnership activities
- Coordinated response the Code T RFI for exploration concept papers
- Jim Watzin named Program Manager for Lunar Reconnaissance Mission in 2008 - moving along with mission

Next Steps



- Contribute to near term Code T needs and activities via Point of Contact and assignment of engineers and scientists to emerging teams and activities
- Continue collaborative efforts with other organizations for Exploration
- Progress in the formulation of Robotic Lunar Exploration Program and in the planning of the Hubble Robotic Servicing mission
 - Leverage these efforts toward developing Exploration building blocks and in meeting future needs
 - Develop capabilities (e.g. early concept development, demonstration and validation, testbeds) to contribute toward the evolution of future Exploration elements
- Create a GECO organization and staff it